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(54) **A microprocessor-controlled display unit**

(57) The adjustments and settings of the display unit 25 are performed by means of a separate mouse 3, keyboard 2 and/or some other similar user interface connected to a connector 11, 12 in the display unit 25 and thereby to a microprocessor control 15 of the display unit.

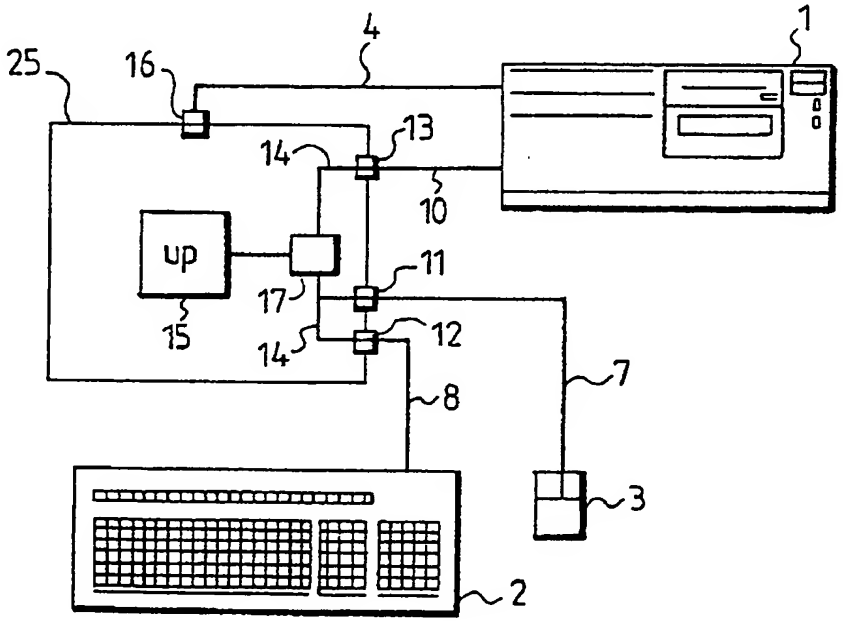

FIG. 3

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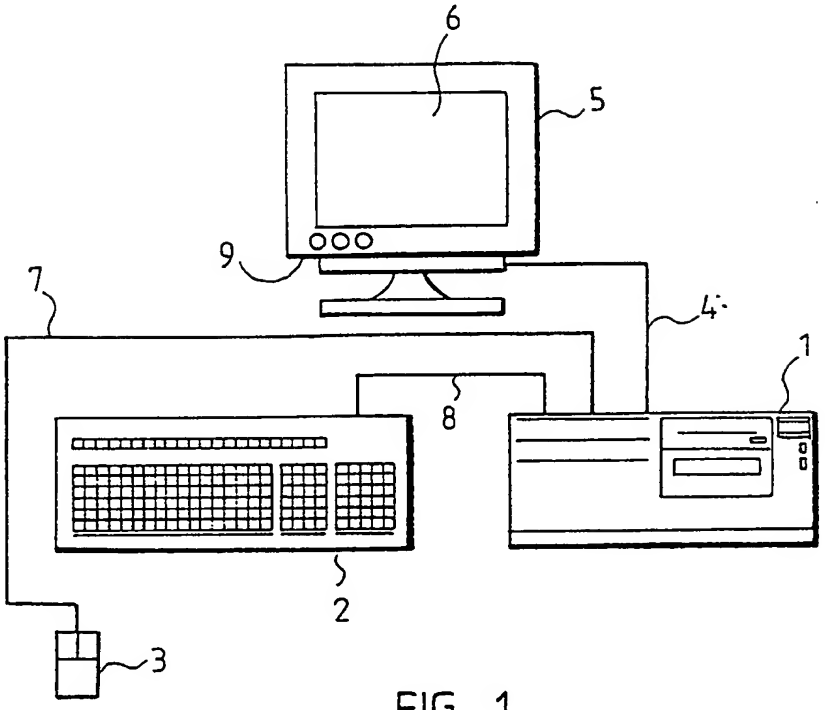

FIG. 1

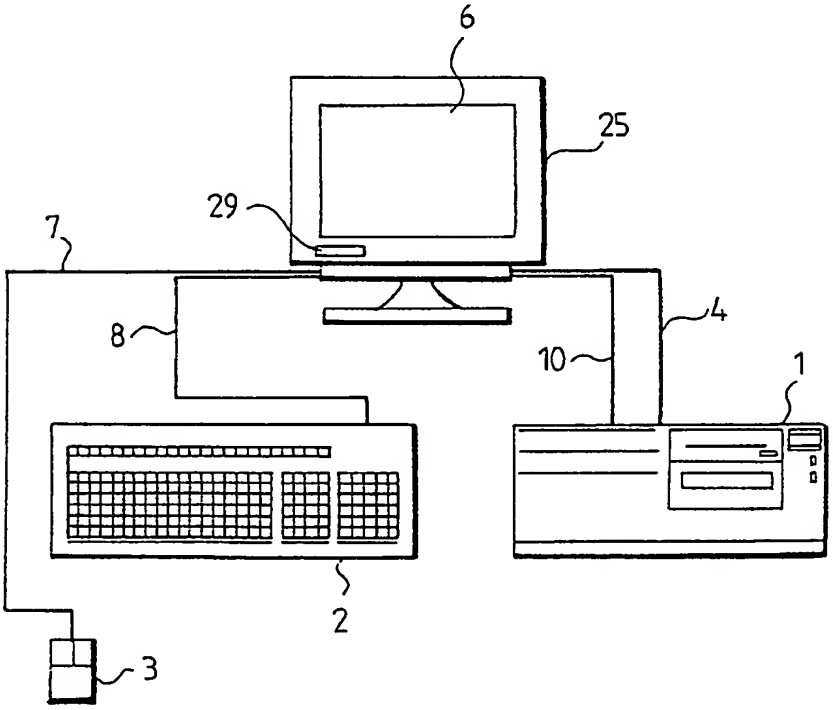

FIG. 2

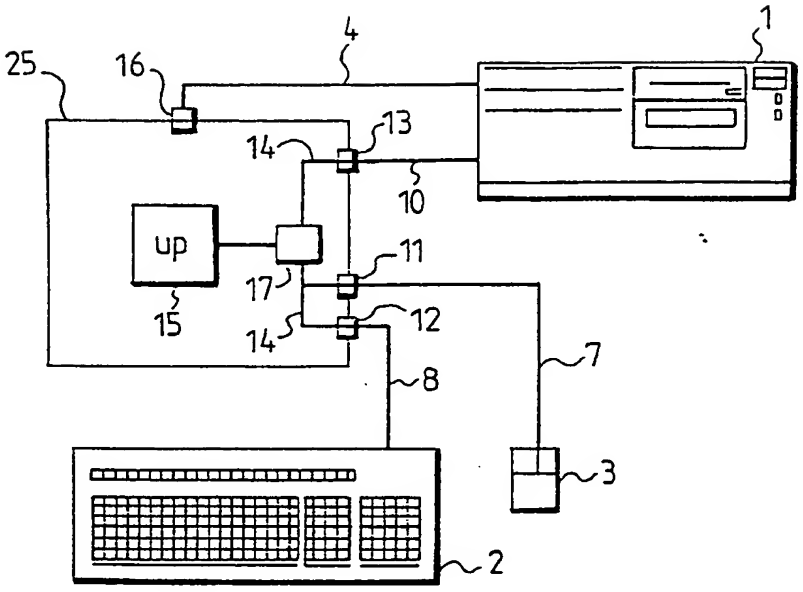

FIG. 3

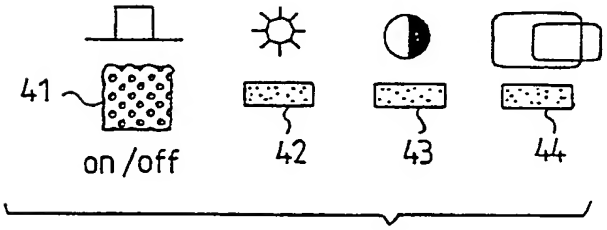

FIG. 4

A microprocessor-controlled display unit

The invention relates to microprocessor-controlled displays, and particularly to user operated adjustments and settings in the display.

Computer systems, such as a personal computer, generally comprise a central processing unit (CPU), to which may be connected a keyboard, a mouse as well as a display terminal (monitor), as illustrated in Figure 1. As known, the central processing unit of a computer includes a video display adapter (e.g. a VGA adapter) generating a video signal/video signals applied to the display over a video interface and a video cable. Typically, a conventional display supports only one display standard, which is compatible with a display adapter in the CPU.

Nowadays, there are various monitors/displays with an internal microprocessor control and capability of operating in several different display standards or modes; e.g. at various display resolutions from an EGA resolution up to a 1280 x 1024 resolution. Such monitors are generally called multi-frequency or multisync monitors. A multisync monitor is capable of shifting quickly from one display mode to another according to the current application. However, especially in the case of non-standard display modes, the problem may exist that the adjustments of the position and size of an image displayed on a screen or other similar adjustments made in one mode are no more proper for the new display mode. Therefore, the multisync monitor requires several separate adjusters for adjusting properties relating to the

appearance of the image.

Previous solutions for adjusting a display device have been based on a computer equipment of the type shown in Figure 1. The display unit is provided with adjusters/an adjusting unit, which is easy but expensive to implement. The adjusting unit is usually easy to comprehend for the user, but not necessarily easy to use. Although the adjusters are normally located within the reach of the user in the front or rear panel of the monitor, the user must reach out closer to the monitor in order to adjust the monitor, which makes it more difficult to change and estimate the property to be adjusted to correspond to the normal situation and distance of use. In addition, the user adjusting unit restricts the alternatives in the design and the mechanical structure of the monitor and makes them more complicated, because the electronics of present monitors is typically on a single circuit board, which also contains said adjusting unit. Modifying the structure of the monitor afterwards is difficult or even impossible. Factory preadjustments as well as maintenance adjustment are possible, but cumbersome and slow (a manual procedure). All desired adjustments cannot necessarily be performed by means of the adjusting unit of the monitor.

Further solutions are known in which the intention is to adjust the display unit by means of a non-standard control from the CPU e.g. by utilizing a Windows-based control program. This last-mentioned approach is represented by Patent Application FI-914435, which utilizes a display adapter and a video interface for data communication between a CPU and a display unit. An adjustment of this type can be made easily comprehensible for the user, but the adjusting

itself is not quite simple: each time the user wants to adjust the monitor he has to interrupt the current application program and to load an adjustment program. In addition to the above disadvantage, the adjustment may include user visible delay due to the slowness of the display adapter and the communication bus. Moreover, the adjusting window on the display should be within the screen of the display, which means that the adjusting window must not move when the position of the image on the screen is adjusted. A dedicated adjustment program has to be developed for each operating system (DOS, Windows, OS/2, Unix, etc.), which results in a cumbersome and expensive development and maintainance of the adjustment program. Additionally, compatibility problems may occur as far as the data communication bus is concerned. This kind of solution for adjusting a monitor does not suit well for an end user, but rather for making factory or maintenance presettings or for altering these presettings. In the latter case, the timing/response of the adjustment is not critical, because the adjustment does not affect directly to a displayed image, but adjustment parameters are stored in a memory of the monitor for future use.

The object of the present invention is a novel way of adjusting a video display so that the above disadvantages and problems will be overcome.

According to the invention, a microprocessor-controlled display unit comprising user operated means for performing adjustments or settings of the display unit is characterized in that the display unit comprises connecting means for the connection of a user interface means, such as mouse or keyboard,

via the display unit to a computer operating as a video signal source, and that said means for performing the adjustments or settings of the display unit comprise said user interface means connected over said connecting means to a microprocessor control in the display unit.

The basic idea of the invention is to perform the adjustments of a display device - for which is traditionally needed an adjusting unit in the display unit - by utilizing a keyboard, a mouse or another similar standard user interface. Such a user interface is then firstly connected to the display unit instead of the central processing unit (CPU) and from the display unit to the CPU. Inside the display unit, signals of the user interface are connected also to the microprocessor of the display unit so that the user may control the microprocessor by means of the user interface and thereby perform the adjustments and settings he desires. The user interface bus to the CPU of the computer is interrupted for the time of the adjustment either manually or by the microprocessor of the display unit.

Various advantages are achieved by means of the invention:

- No separate adjusters are needed in a display unit, as a consequence of which the structure of the display unit becomes simpler and cheaper and easier to design.

- Since existing keyboard and/or mouse of a computer system (or possibly some other peripheral device suitable for the inventive adjustment) is used for adjusting a display unit, no extra costs arise because of an adjusting device.

- The keyboard of a computer does not set any limits to the number of adjusted properties of a dis-

play unit. Adjustments are easily removed or added, if needed, without having to change the mechanical structure of the display unit itself.

- By an adjustment based on the keyboard or mouse of a computer, it is possible to implement various advanced user interfaces for adjusting a display unit.

- The solution is compatible with the existing computer (PC) systems.

- The CPU does not need to participate at the adjustment of the monitor in any way, and therefore, no extra non-standard device drivers are required.

- The response time of the adjustment does not raise any problems, because adjusting information passes almost in real time from the keyboard or mouse directly to the microprocessor of the display unit.

- The keyboard and mouse may be connected directly to a display unit, which is within the reach of the user, and not to the CPU, which may be situated beyond reach. Thus, it is possible to have the CPU situated out of sight, e.g. under a table, without making the use and the connection of the keyboard/mouse to the system more difficult. No long cables from the keyboard and mouse are then needed either.

- All means needed for the adjustment are within the reach of the user's hand, and therefore, it is not necessary to change the normal working position when estimating an adjustment of an image property.

- A keyboard/peripheral device interconnection between the monitor and PC may be utilized as a communication bus, e.g. for transmitting factory and maintenance presettings from the PC to the memory of the monitor. The bus may be bidirectional so that also the monitor can send e.g. monitor identification

information to the PC.

- The number of interconnection cables between the peripheral devices does not increase substantially from the present number. Since the keyboard and the mouse are connected to the display unit each of them separately, the previously planned expensive solution for integrating the keyboard and the mouse will be avoided. It is then not necessary to position a special expensive mouse connector in an inexpensive and standard PC keyboard, but the additional costs needed are transferred to the display unit, which always supports the control of the PC keyboard.

In the following, the invention will be described by means of illustrating examples referring to the attached drawings, in which

Figure 1 illustrates a prior art computer system with a display unit, and

Figure 2 and 3 show a computer system with a display unit according to the invention.

In a computer system as shown in Figure 2, a user interface, in the example case a keyboard 2 and a mouse 3, is connected by means of cables 8 and 7, respectively, to a display unit 25 according to the invention and from there further by means of a common cable 10 to a central processing unit 1 (CPU). Between the CPU 1 and the display unit 25 there is also in a conventional manner a video cable 4 for transmitting a video signal.

The display unit 25 is a microprocessor-controlled display, i.e. the operation is controlled and the necessary adjustments are performed by a separate

internal microprocessor system 15. The microprocessor system 15 may be programmed to perform almost any controls and adjustments, but the most usual ones for the user are various settings of an image displayed on a screen, such as settings of size, position, luminance, contrast, etc. Traditionally, a display unit comprises separate adjusters for these adjustments, such as adjusters 9 of the display unit 5 of Figure 1, by means of which the user may control the microprocessor system 15.

In the display unit 25 according to the invention, the user performs all adjustments by means of a user interface, such as the keyboard 2 or the mouse 3, connected to the display unit. In the preferred embodiment of the invention shown in Figure 3, the display unit 25 is for this purpose provided with a standard mouse connector 11, to which the mouse 3 is connected by means of the connection cable 7, and with a standard keyboard connector 12, to which the keyboard 2 is connected by means of the connection cable 8. Inside the display unit 25, there is for each user interface a standard data bus 14 extending from the connectors 11 and 12 via a switching unit 17 to the microprocessor system 15 and to a third connector 13, to which is connected a connection cable 10. The other end of the cable 10 is connected to a user interface connector in the CPU 1, typically to the keyboard/mouse connector. The internal data bus 14 contains the same signals as the connection cables 7, 8 and 10 and is thus in a way only an extension of them inside the display unit 25. In the preferred embodiment of the invention, the keyboard 2, the mouse 3 as well as the connectors 11, 12 and 13 are of PS/2 type.

In normal use, signals generated by the key-

board 2 and the mouse 3 are transferred through the cables 7 and 8 to the connectors 11 and 12 and from there along the internal bus 14 to the connector 13, from which the signals are connected to the CPU 1 by means of the cable 10. This means that the user interface signals are only looped through the display unit 25, which offers them the necessary physical connection in form of the connectors 11 and 12.

When initiating adjusting the monitor, the switching unit 17 disconnects the bus 14 to the connector 13 and interrupts thus the connection to the CPU 1, so that false control procedures will be avoided in the CPU.

An adjustment may be initiated and the switching unit 17 may be controlled by the microprocessor 15 as a consequence of a command from the keyboard, for instance, or manually by means of a separate switch.

In the first-mentioned case, the microprocessor system 15, which is also connected to the internal bus 14, is during normal operation in a monitoring mode, in which it monitors the signals of the bus 14. In the monitoring mode, the microprocessor system responds only to a predetermined signal/sequence of signals on the bus 14, by employing an active adjustment mode and controlling the switching unit 17 to disconnect the delivery of signals in the bus 14 to the CPU 1. Thus all signals from the user interface and transferred on the bus 14 control the adjustments and settings of the display unit. After the user has performed the desired adjustments, the active adjustment mode is terminated and the monitoring mode restored by inputting a predetermined control signal from the user interface. At the same time, the microprocessor system 15 controls the switching unit 17 to

connect the bus 14 also to the connector 13.

A high quality adjustment of a display unit is supposed to be comprehensible and easy to use (i.e. ergonomic) and it is supposed to indicate in one way or another the present adjustment mode and the present position in the adjustment range. It may be difficult, even impossible, in practice to implement an ergonomic adjustment of a display unit without any kind of switches and indicators in the monitor itself.

For this reason, the purpose of the preferred embodiment of the invention is a simplicity of the adjustment and a minimization of the number of adjusters so that there is no need to compromise over these requirements of the high quality adjustment. The front panel of the display unit 25 shown in Figure 2 and 3 is provided with a switch and indicator unit 29 relating to the adjustment. The unit 29 is shown more detailed in Figure 4. The unit 29 comprises a separate on/off switch 41, by means of which the user sets the monitor into an adjustment mode manually and disconnects the bus 14 simultaneously from the connector 13. The unit 29 further comprises three indicator lights (LEDs) 42, 43 and 44, indicating various adjustment modes: e.g. adjustment of luminance, contrast and image position.

The adjustment operation of the display unit 25 may be performed by the keyboard or by the mouse, for example as follows:

1) The display unit 25 is set to an adjustment mode by means of the switch 41. The switch 41 disconnects the keyboard/mouse bus to the PC 1. All indicator lights 42, 43 and 44 are lighted up for a moment to indicate the transition to the adjustment mode.

2) By means of the lighted indicator, the dis-

play unit 25 indicates the type of adjustment mode (luminance, contrast, image position). By means of horizontal cursor keys of the keyboard 2 or by stepping with the left/right control button of the mouse 3, it is possible to move to the adjustment mode desired. Upon reaching the adjustment mode desired, selection of the mode is acknowledged for instance by pressing the ENTER key of the keyboard 2 or by pressing twice the left control button of the mouse 3.

3) The selected image property is adjusted by means of vertical and/or horizontal cursor keys of the keyboard 2 or by moving the mouse 3 in the direction X/Y. After the maximum or minimum limit of the adjustment has been achieved, the indicator light 42, 43 or 44 of the selected adjustment mode starts flashing. After the desired adjustment has been achieved, the setting of the adjustment is acknowledged e.g. by pressing the ENTER key of the keyboard 2 or by pressing twice the left control button of the mouse 3.

4) The adjustment mode of the display unit is exited by means of the switch 41.

The invention has been described above in the surroundings of a PC equipment. However, the invention is well suitable for use in other applications, too, as for instance in computer terminals having an associated keyboard already connected to the terminal display unit.

In any case, the enclosed figures and the associated description are only intended to illustrate the present invention. As to the details, the display unit according to the invention may vary within the scope of the attached claims.

CLAIMS

1. A microprocessor-controlled display unit comprising user operated means for performing adjustments or settings of the display unit, wherein the display unit comprises connecting means for the connection of a user interface means, such as mouse or keyboard, via the display unit to a computer operating as a video signal source, and that said means for performing the adjustments or settings of the display unit comprise said user interface means connected over said connecting means to a microprocessor control in the display unit.

2. A display unit according to claim 1, wherein the microprocessor control is normally in a first mode of operation, in which the microprocessor control monitors signals sent by the user interface means, but responds only to a predetermined signal by moving to an active adjustment mode, in which all signals from the user interface control the adjustments and settings of the display unit.

3. A display unit according to claim 1, wherein the display unit comprises a switch means for the connection of the microprocessor control to the adjustment mode.

4. A display unit according to claim 1, 2 or 3, wherein forwarding of signals sent by the user interface means from the display unit to the computer is interrupted when the microprocessor control is in the active adjustment mode.

5. A display unit according to any one of the foregoing claims, wherein the keyboard and the mouse are connected to the display unit.

6. A display unit according to any of the foregoing claims, wherein the display unit comprises means for indicating various adjustment functions to the user.

7. A display unit according to any of the foregoing claims, wherein the keyboard and/or mouse is of PS/2 type.

8. A microprocessor-controlled display unit constructed and arranged substantially as hereinbefore described with reference to and as shown in Figures 2 and 3 of the drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9317875.4
Relevant Technical Fields (i) UK Cl (Ed.L) H4T (TABL,TACC,TACP,TACR); G4A (ADT,AKBX) (ii) Int Cl (Ed.5) G06F 1/16, 3/02 G09G 1/04, 5/00, 5/18 H04N 3/27, 5/46	Search Examiner P J EASTERFIELD Date of completion of Search 2 November 1993
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASES: WPI	Documents considered relevant following a search in respect of Claims :- 1 to 7

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A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
Y	GB 2222353 A	(IBM)	1
Y	GB 2216692 A	(GILL)	1,5
Y	GB 2190267 A	(FLUKE)	1
Y	GB 2176679 A	(SONY)	1
Y	GB 2166028 A	(SONY)	1
Y	EP 0140647 A1	(IBM)	1,5

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